

DETAILED ACTION

Continued Examination Under 37 CFR 1.114

A request for continued examination under 37 CFR 1.114, including the fee set forth in 37 CFR 1.17(e), was filed in this application after final rejection. Since this application is eligible for continued examination under 37 CFR 1.114, and the fee set forth in 37 CFR 1.17(e) has been timely paid, the finality of the previous Office action has been withdrawn pursuant to 37 CFR 1.114. Applicant's submission filed on 22 March 2010 has been entered.

Response to Arguments

Applicant's arguments with respect to the rejection(s) of claim(s) 2 – 14 have been fully considered and are persuasive. Therefore, the rejection has been withdrawn. However, upon further consideration, a new ground(s) of rejection is made in view of Meyers in view of Huang, et al. (US 20030044729 A1.)

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

Claims 2 – 5, 9 – 14, and 16 – 18 are rejected under 35 U.S.C. 103(a) as being unpatentable over Meyers (EP 0809124 A2) in view of Huang, et al. (US 20030044729 A1.)

Regarding **claim 9**, Meyers discloses a solid-state imaging apparatus comprising arranged unit pixels (R, G, B, Fig. 2), each of which includes a light collector (diffractive/refractive lenslet array) and a light receiver (individual pixels.) More specifically to the present application, Meyers discloses that the light-collector comprises: a substrate into which the incident light is incident (photosensitive imaging array, 30) and a plurality of light transmitting films (lenslets, 12) formed in a region in which the incident light is incident above said substrate (lenslet array, 10.)

The limitation wherein each light-transmitting film forms a zone in which a width of each zone is equal to or shorter than a wavelength of the incident light is inherently present in Meyers. The lenslet array is made of achromatized refractive/defractive lenslets [p. 3, ln. 46], meaning that lenslet array has been fabricated in such a way such that there are zones (in this case, the area within the concentric circles) that become progressively smaller as the circles expand from the local center (Fig. 1.) This spacing defines a zone width that directs the incident light in a certain manner – in this case, toward the photosensitive site [p. 4, ln. 43 – 55.] Although this is not explicitly stated, these zone widths must be equal to or shorter than a wavelength of the incident light because that is how diffraction grating lenses are formed (for example, see Shiono, et al., US 5,742,433, Figs. 4, 5 or Kobayashi, US 2002/0001066, Figs. 5A/B.) Because

Art Unit: 2622

this property is inherent in refractive lenslets, this limitation is considered disclosed by Meyers

However, Meyers fails to disclose that each zone shares a center point which is located at a position displaced from the center, forming an effective refractive index distribution, and that the unit pixel is located in a center of a plane is at a position at which an effective refractive distribution of a corresponding light collector is a maximum, and that the pixels at the periphery are also at a maximum value.

Despite this, the Examiner maintains that it would be obvious to one of ordinary skill in the art to include such limitations, as taught by Huang, et al. (hereafter, "Huang.")

Huang discloses a solid state imaging device (Fig. 2c) where a diffraction grating (212) is set per photosensitive area (202.) Fig. 3 illustrates that each pixel has its own diffraction array, where the central axis of each pixel matches the central axis of the corresponding diffraction array, so that each diffraction array is specifically designed to bend light to its singular photosensitive site (202.)

If this practice is applied to the diffraction structure disclosed in Meyers (i.e., the lenslet arrays of Meyers Fig. 1 applied to each individual photosite as shown in Huang Fig. 3, as opposed to a series of pixels), then it would be clear that the light incident upon the each of the pixels would be specifically bent toward the center of that specific corresponding pixel in order to obtain the maximum possible signal level.

In this way, it would follow each zone sharing a center point which is located a position displaced from the center of said device and that the plurality of light transmitting films form an effective refractive index distribution. The shifted diffraction

Art Unit: 2622

structure would be more acclimated to obtain light at an angle, thereby ensuring that a wide majority of the incident light is collected by the corresponding light collector (as shown in Figs. 3 - 5 of Meyers.)

Additionally, if this structure is used, it would similarly follow that a unit pixel, among said unit pixels, which is located in a center of a plane on which said unit pixels are formed, a position at which an effective refractive distribution of a corresponding light collector is a maximum value matches a central axis of a corresponding light receiver. Because each diffraction array is assigned to a specific corresponding pixel, then the pixels toward the center would have a maximum value at the central axis (i.e., center values of Meyers Fig. 1 have a centralized midpoint.)

Finally, if this structure is used, it would also follow that a unit pixel, among said unit pixels, which is located in a periphery of a plane on which said unit pixels are formed, a position at which an effective refractive distribution of a corresponding light collector is a maximum value is displaced from the central axis of a corresponding light receiver toward the center of the plane. Because the diffraction array has a midpoint off-set from the center of the diffraction grating, then light bent at an angle (toward the area of the periphery) would be redistributed toward the center of the specific corresponding pixel (again, as shown in Fig. 5 of Meyers.)

Therefore, it would be obvious to one of ordinary skill in the art to use the diffraction array-per-pixel teaching of Huang with the invention of Meyers, because by having a specific array assigned to each pixel, the user can ensure that the greatest

Art Unit: 2622

amount of light is being directed specifically toward said pixel. By ensuring that the light is at a maximum, a higher luminance image can be obtained for an overall better image.

Regarding **claim 2**, the combination meets the limitations of claim 9, as discussed above. Furthermore, Meyers discloses that the incident light is collected in a center plane made of said light transmitting films and that the incident light is incident at an angle asymmetrical to the center of the plane made of said plurality of light-transmitting films (Fig. 2)

Regarding **claims 3 and 4**, the combination meets the limitations of claim 9, as discussed previously. However, Meyers does not specifically disclose an amount of phase change of incident light approximately according to the equation:

$$\phi(x) = Ax^2 + Bx \sin(\theta) + 2m\pi .$$

Meyers also does not specifically disclose a difference of refractive indices according to the equation:

$$\Delta n(x) = \Delta n_{\max} \left[\frac{\phi(x)}{2\pi} + C \right] .$$

Despite these, it is assumed that, when a semiconductor compound recited in the reference is substantially identical to that of the claims, claimed properties or functions are presumed to be inherent. Because the lenslets are diffractive/refractive in nature, adapted to direct incident light upon a specific point in the substrate, they meet this requirement. Where the claimed and prior art products are identical or substantially

Art Unit: 2622

identical in structure or composition, or are produced by identical or substantially identical processes, a *prima facie* case of anticipation has been established. *In re Best*, 195 USPQ 430, 433 (CCPA 1977.)

As such, these equations are considered inherently present in Meyers.

Regarding **claim 5**, the combination satisfies claim 9 and further Meyers discloses that the heights of the plurality of light transmitting films (lenslets, 12) are constant in a direction normal to said plurality of light transmitting film (Fig. 2.)

As to **claim 10**, the combination meets the limitations of claim 9 and further discloses that there are off-centered light-transmitting films (the full lenslet array with multiple off-centered lenslet segments, Fig. 1) is also formed in an area shared by one light-collector and another light-collector in an adjacent unit pixel (multiple pixels, 20, within a single lenslet segment, Fig. 2.)

As to **claim 11**, the combination meets all of the limitations of claim 9, as earlier discussed. Additionally, Meyers discloses a first unit pixel device and a first light-collector (20, "R") for a first color light out of incident light (red.) Meyers continues disclosing a second unit pixel and a second light-collector (20, "G") for a second color light which has a typical wavelength that is different from a typical wavelength of the first color light (red and green have different wavelengths). Finally, the focal length of the

Art Unit: 2622

second color is equal to a focal length of the first color light in said first light-collecting devices (Figs. 3A, 4A, 5A.)

As to **claim 12**, the combination meets the limitations of claim 9 and further Meyers discloses that the focal point is set at a predetermined position by controlling an effective refractive index distribution of said light-transmitting film (p. 5, ln. 10.)

As to **claim 13**, the combination meets the limitations of claim 9 and further Meyers teaches that each of the unit pixels further includes a light-collecting lens (lenslets, 12) on a light-outgoing side of the said light-collector.

As to **claim 14**, the combination meets the limitations of claim 9 and furthermore Meyers illustrates in Fig. 1 that an effective refractive index distribution of said light-transmitting film is different between light-collectors of said unit pixels located at the center of a plane on which said unit pixels are formed and light-collectors of said unit pixels located at the periphery of the plane. Meyers also discloses this in the tables reflecting the adjusting values dependent on the degree field (Example A, B, C.)

Regarding **claim 16**, the combination satisfies the limitations of claim 9. Additionally, Meyers inherently discloses that the light-transmitting films of the central pixels has a line width different from that of the films of the periphery of the area.

As shown in Fig. 1, Meyers discloses that each of the lenslet arrays has a central point (central point of the concentric circles) shifted from the center of the corresponding pixel, except for the pixel in the absolute center, which has a center that it shares with the corresponding pixel. Because the center is shifted in various directions, then the line widths of each zone inherently differs between each pixel.

Furthermore, because the line widths differ between each pixel, it further follows that the sum of line widths of one pixel would also differ.

Therefore, this property is considered inherent in Meyers, and is, therefore, considered disclosed by the combination.

Regarding **claim 17**, the combination satisfies the limitations of claim 16. Additionally, as shown in the rejection to claim 16, the line widths between each pixel varies due to its distance from the center. Again, because the pixels toward the periphery have the greatest shift from the center, its line widths are shorter than those toward the center of the pixel. As Fig. 1 of Meyers illustrates, the pixels toward the periphery have diffraction grates of minute distances as the grating nears the center, whereas the central pixel only as a few grates of larger width.

Claim 18 is a variant of claim 17 and is, therefore, interpreted and rejected accordingly.

Claims 6 – 8 are rejected under 35 U.S.C. 103(a) as being unpatentable over Meyers in view of Huang and further in view of Dellwo, et al. (US 7,390,532 B2.)

Regarding **claims 6, 7 and 8**, the combination of Meyers and Huang meets all of the limitations present in claim 9, as discussed in a previous section. However, Meyers fails to disclose the light-transmitting films including one of the compounds claimed in claims 6, 7, or 8. Despite this, the Examiner maintains that it was well known in the art to include these compounds in the creation of the lenslets, as disclosed by Dellwo, et al. (hereafter, "Dellwo.")

Dellwo discusses a method for the production of optical elements with gradient structures. In his method, he discloses that the optical elements (light-transmitting films) includes one of TiO_2 , ZrO_3 , Nb_2O_5 , Ta_2O_5 , Si_3N_4 , and Si_2N_3 (c.9, ln. 1 – 14.) He also discloses that the optical elements includes one of SiO_2 doped with B or P (Boro-Phospho Silicated Glass) and Teraethoxy Silane (c. 7, ln. 51 – 64.) Finally, Dellwo discloses the optical element including one of benzocyclobutene, polymethacrylate, polyamide, and polyimide (c. 6, ln. 13 – 31.)

Because the lenslets of the lenslet array are themselves "optical elements with a gradient structure" – that is, a diffractive gradient optical element – it would be obvious to one of ordinary skill in the art that such a process as defined by Dellwo, as doing so would allow one to manufacture the lenslets and, further, lenslet array used in the invention disclosed by the combination of Meyers and Huang.

Citation of Pertinent Art

The prior art made of record is considered pertinent to the applicant's disclosure, but is not relied upon as a reference for the preceding sections:

- Orita, et al. (US 20060125948 A1) discloses a solid stat imaging element with a diffraction grating.
- Hirai, et al. (US 20050195485 A1) discloses an optical device with a sub-wavelength grating.
- Te Kolste, et al. (US 20040042081 A1) discloses a multi-level diffraction grating.
- Nakai (US 20030231395 A1) discloses a diffractive optical element.
- Hakatoshi, et al. (US 5978139 A) discloses a optical disk recording apparatus with a diffraction grated lens.
- Robins, et al. (US 20030164922 A1) discloses a diffractive focusing device.

Conclusion

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Dwight Alex C. Tezano whose telephone number is (571) 270-7200. The examiner can normally be reached on Monday through Friday 10:00-6:00 with alternate Fridays off.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, David L. Ometz can be reached on (571) 272-7593. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Art Unit: 2622

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